

REMARKS

Examiners Harrison and Smoot are thanked for their courtesy in granting an interview on February 22, 2006 to discuss the present application. In the interview, the attorney for the Applicants explained how the structure disclosed in the principal reference is totally different from the structure set forth in the independent claims of the present application and that these claims are not anticipated by the cited art. Examiner Harrison was not ready at that time to make a decision on the allowability of any claims, so it was agreed that arguments concerning the allowability of the claims would be presented in a written response.

On page 2 of the Official Action of January 24, 2006, claims 1 - 9, 21 - 24, and 27 - 29 were rejected under 35 USC 102(b) as anticipated by Gaku et al (U.S. Patent No. 6,097,089, referred to below as Gaku). This rejection is respectfully traversed.

Each of independent claims 1, 28, and 29 describes a solder ball assembly including a plurality of solder balls disposed in holes in a heat-resisting sheet and held in the holes by an adherent layer inside the heat-resisting sheet. Gaku does not disclose such an arrangement.

Gaku discloses a semiconductor plastic package. As shown, for example, in Figure 2 of Gaku, the package basically comprises a printed wiring board, a semiconductor chip mounted on the top surface of the printed wiring board, and an electric circuit

(referred to in Gaku as a "reverse surface circuit") formed on the bottom surface of the printed wiring board. The reverse surface circuit includes solder ball pads on which solder balls i can be mounted to connect the package to a mother board, for example. From any of the figures of Gaku, it can be seen that Gaku does not disclose any solder balls i disposed in holes in a heat-resisting sheet. The only holes present in the structure of Gaku are through holes e, which function as vias for connecting the circuits on the top and bottom sides of the printed wiring board to each other. Clearly the solder balls i are not disposed in any of the through holes e or in any other holes. Furthermore, the solder balls i are also not held by any adherent layer. The solder balls i are bonded to solder ball pad portions which have been plated with nickel or gold (column 12, line 5); in other words, the solder balls i are metallurgically bonded to the solder ball pad portions by partial melting of the solder balls i. Note in Figure 2 of Gaku how the upper surfaces of the solder balls i are flattened where they contact the solder ball pad portions; this flattening is the normal result when a solder ball is partially melted to attach it to a bonding pad.

To better illustrate the differences in structure between Gaku and the claims of the present application, an enlarged, marked-up copy of Figure 2 is attached to the end of this response as Attachment A. The upper and lower layers of metal foil d shown in Figure 1 of Gaku (which the Official Action described as heat resisting layers) are not visible in Figure 2 but are present underneath the circuits on the top and bottom

surfaces of the printed wiring board (i.e., between the circuits and the cured resin layer) as an electrical ground layer. The outer layer which Gaku describes as a plating resist is what is normally referred to as a solder mask, which is an extremely hard, cured polymer which covers the copper traces on both the top and bottom circuits of the printed wiring board but not the bonding pads for the solder balls.

From Attachment A, it is evident that the solder balls are not disposed in any holes in a heat resisting sheet and are not contacted and held by any adherent layer. Indeed, in the arrangement shown in Attachment A, there is no adherent layer, since both the resin layer inside the printed wiring board and the solder mask on the outer surface of the printed wiring board are completely cured and have no adhesive powers at all.

Thus, since Gaku fails to disclose any solder balls disposed in holes in a heat-resisting sheet and held in the holes by an adherent layer inside the heat-resisting sheet, it does not disclose all the features set forth in independent claims 1, 28, or 29 and so cannot anticipate these claims. Independent claims 1, 28, and 29, and claims 2 - 9, 21 - 24, and 27 which depend from claim 1 are therefore allowable.

In reviewing the rejections of claims 1 - 9, 21 - 24, and 27 - 29, the Applicants noted a number of discrepancies between descriptions of the Gaku reference found in the Official Action

and the actual written description and drawings of Gaku, suggesting that the Examiner may have misunderstood certain features of the structure of Gaku. Some of those discrepancies are as follows:

(a) Concerning claim 1, paragraph 2 of the Official Action states that Gaku discloses an adherent layer c (which is a resin layer) contacting and holding solder balls i in holes. However, Figure 2 of Gaku shows not only that the solder balls i are not disposed in holes, but also that there is no contact between either of the resin layers c and the solder balls i. Paragraph 2 of the Official Action also describes element a in Figure 1 as being a covering sheet which is spaced from an adherent layer and covers solder balls disposed in holes. However, element a is actually a metal sheet which forms a core of the printed wiring board, and it directly contacts the resin layers c which the Official Action defines as being adherent layers. Furthermore, element a does not cover the solder balls i, for it can be seen from Figure 2 that the solder balls i are in a bare, uncovered state.

(b) Concerning claim 5, paragraph 6 of the Official Action states that each hole e in Figure 1 of Gaku is straight, yet paragraph 7 of the Official Action states in connection with claim 6 that the same hole e is tapered. The identical hole cannot be both straight and tapered.

(c) Concerning claim 7, paragraph 8 of the Official Action states that Gaku discloses a blind hole e in Figure 1. However, column 7, line 7 of Gaku identifies element e as a "through hole for conduction between front and reverse circuits". Since element e is a through hole, it cannot be a blind hole. Thus, there is no support in Gaku for the rejection of claim 7.

(d) Concerning claims 8 and 9, paragraphs 9 and 10 of the Official Action state that Gaku discloses a blind hole e having a depth smaller than the diameter of a solder ball disposed therein. However, the holes e are through holes and not blind holes; furthermore, as can be seen in Figure 2, the depth of each through hole e is far greater than the diameter of the solder balls i; in addition, there are no solder balls i disposed in the through holes e. Thus, there is no support in Gaku for the rejections of claims 8 and 9.

(e) Concerning claim 24, paragraph 14 of the Official Action states, referring to Figure 5, that Gaku discloses a covering sheet conforming to the shape of solder balls. However, the solder balls i in Figure 5 are quite clearly exposed to the exterior and not covered by any covering sheet, shape-conforming or otherwise. Thus, Gaku does not provide any support for the rejection of claim 24.

(f) Concerning claim 27, paragraph 15 of the Official Action describes element a in Figure 1 as being a covering sheet

directly contacting solder balls. However, according to column 7, line 6 of Gaku, element a is a metal sheet which forms a core of the printed wiring board of Gaku. It is not a cover sheet, and it has no contact at all with the solder balls i. As a result, there is no support in Gaku for the rejection of claim 27.

(g) Concerning claim 28, paragraph 16 of the Official Action states that Gaku discloses an adherent layer c (a resin layer) contacting and holding solder balls in holes. However, Figure 2 shows that there is no contact between the solder balls i and either resin layer c. Figure 2 also shows that the solder balls i are not disposed in holes, and that the solder balls i are not held in holes by either resin layer c. Thus, there is no support in Gaku for the rejection of claim 28.

(h) Concerning claim 29, paragraph 17 of the Official Action states that Gaku discloses heat resisting layers d (metal foil) and an adherent layer sandwiched between the heat resisting layers d. It is assumed from the earlier paragraphs that the Official Action is referring to one of resin layers c forming the printed wiring board of Gaku as the adherent layer. However, as stated above, Figure 2 of Gaku shows that there is no contact whatsoever between the solder balls i and either resin layer c; that the solder balls i are not disposed in holes; and that the solder balls i are not held in holes by either resin layer c. Therefore, Gaku provides no support for the rejection of claim

29.

Paragraphs 3 - 5 and 10 - 13 of the Official Action contain similar discrepancies due to their reliance on the description of Gaku found in paragraph 2 of the Official Action.

It is believed that if the Gaku reference is properly interpreted, it will be seen that it does not anticipate any of claims 1 - 9, 21 - 24, and 27 - 29.

On page 5 of the Official Action, claim 18 was rejected under 35 USC 103(a) as unpatentable over Gaku in view of Akagawa (U.S. Patent No. 5,866,415). This rejection is respectfully traversed.

According to MPEP 706.02(j), in the case of a rejection under 35 USC 103, the examiner should set forth in the Office action, among other details, the difference or differences in the claim over the applied reference(s), and the proposed modification of the applied reference(s) necessary to arrive at the claimed subject matter.

The Official Action has not satisfied either of these requirements with respect to claim 18. Claim 18 is a method claim which recites specific steps. In rejecting claim 18, the Official Action relies upon Gaku for disclosing a certain structure, and it relies upon Akagawa as disclosing certain other structure, i.e., electrodes. Nowhere, however, does the Official Action show where either references discloses any method step,

1057

-8-

how method steps in the references (which are not discussed in the rejection) differ from the method steps set forth in claim 18, or how the teachings of the references could be combined to result in a method having all the steps set forth in claim 18. As such, the rejection fails to perform the steps required to set forth a *prima facie* case of obviousness. The rejection of claim 18 is thus defective on its face and should be withdrawn.

Since the Official Action does not identify any method steps in either reference, it is impossible for the Applicants to know exactly how the Official Action proposes to combine the references. However, it appears that no matter how the two references might be combined, they could not reasonably result in a method including a step of removing a heat-resisting sheet of a solder ball assembly from a substrate after forming solder bumps as set forth in claim 18. Column 9, lines 36 - 47 of Gaku describe a procedure for mounting a plastic BGA on a mother board printed wiring board, while Akagawa discloses a printed circuit board having solder bumps 46. Neither reference discloses a step of removing a heat-resisting sheet of a solder ball assembly from a substrate after forming solder bumps. Therefore, since the cited references do not teach all the steps set forth in claim 18, they cannot render this claim obvious. The rejection of claim 18 should therefore be withdrawn.

In light of the foregoing remarks, it is believed that the present application is in condition for allowance. Favorable consideration is respectfully requested.

Respectfully submitted,



Michael Tobias
Registration Number 32,948
Customer No. 27649

#40
1717 K Street, N.W., Suite 613
Washington, D.C. 20036
Telephone: (301) 587-6541
Facsimile: (301) 587-6623
Date: March 1, 2006


Attachment: Attachment A

Certificate of Transmission

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office

on March 1, 2006
(Date of Transmission)

Signature


Michael Tobias